

Addressing Anaemia in Pregnancy: A Comprehensive Global Health Challenge and Multifaceted Strategies for Prevention and Management

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DOI: <https://doi.org/10.38177/ajast.2025.9315>

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Article Received: 05 July 2025

Article Accepted: 14 September 2025

Article Published: 18 September 2025

ABSTRACT

Anaemia during pregnancy is a serious health problem that affects many people globally. It impacts the health of both mothers and their babies, and how often it happens can vary by location. This condition raises the risk of bleeding and issues with the baby's growth because it happens when people don't get enough essential nutrients and deal with money problems. This review examines the various reasons, signs, and increasing seriousness of the problem. It indicates that a balanced method is necessary for prevention. This involves certain supplements, nutrients, improved prenatal care, and education about nutrition. The World Health Organization plans to cut the number of cases in half by 2025. This goal encounters difficulties because there are still issues in the system. This shows that we urgently need special treatments and more money invested in healthcare.

Keywords: Anaemia; Iron Deficiency; Nutrients; Prenatal Care; World Health Organization; Maternal Health; Foetal Outcomes; Nutritional Deficiencies; Low- and Middle-Income Countries; Supplementation; Public Health.

1. Introduction

One of the most prevalent and avoidable nutritional deficiencies in the world, anaemia during pregnancy poses serious risks to the health of both the mother and the foetus. According to World Health Organization (WHO) guidelines, it is defined by a haemoglobin (Hb) level less than 11 g/dL, with trimester-specific adjustments made for physiological haemodilution [1,2]. According to the WHO definition, anaemia is diagnosed in this study when haemoglobin levels drop below 11 g/dL (11.0 g/dL in the first and third trimesters, and 10.5 g/dL in the second). Iron deficiency anaemia, a microcytic hypochromic form, is the most common type worldwide, affecting approximately 30% of women of childbearing age [3-5]. Because decreased oxygen delivery results in fatigue, decreased work capacity, and increased susceptibility to infections, this definition helps identify at-risk groups [6-9].

Millions of people worldwide suffer from anaemia, which causes low birth weight, premature delivery, and maternal death. There are differences in prevalence, with 49% in Egypt [1,10-15], 21.6% in other studies, and a global estimate of 40%, which is higher in low- and middle-income countries (LMICs) [12,16]. Due to inadequate nutrition, infections, and inadequate healthcare in developing regions, there are clear regional differences, with South Asia accounting for 52%, Africa for 46%, and developed regions for 23% [17]. Rates in The Gambia are lower than those in other West African nations, ranging from 60% to 70%, though some report 21.6% [18]. The majority of cases are mild (47%) or moderate (47%), with severity peaking in the second trimester (27.8%) and increasing to 65% in the third (P = 0.03). The WHO divides it into three categories: mild (Hb 10-10.9 g/dL), moderate (Hb 7-9.9 g/dL), and severe (Hb <7 g/dL) [19,20]. 75% of cases of iron deficiency are caused by infections like hookworm or malaria, poor diet, and elevated iron requirements of up to 1,200 mg [1-5]. Haemoglobinopathies, infectious diseases, chronic conditions, and deficiencies in folate and vitamin B12 are

additional factors [12]. Malaria and traditional diets are major factors in The Gambia [21], and the risks are increased by living in a rural area, being illiterate, being over 30, having a short birth interval, not taking supplements, having parasites, having fewer prenatal visits, being multiparous, and having a low income. High tea consumption combined with low consumption of fruits, vegetables, and meat raises risk [22-25]. Blood volume expansion and metabolic changes during pregnancy increase nutrient demands, increasing the risk of anaemia if intake or absorption is insufficient [26].

In addition to foetal growth restriction and prematurity, the consequences include maternal exhaustion, cardiovascular strain, and postpartum haemorrhage [1-5,27]. Severe cases result in low birth weight, preterm birth, hypertension, and miscarriage; anaemic women are more likely to experience these and other complications [28,29]. In Egypt, postpartum haemorrhage rates increase, and newborns of anaemic mothers have lower birth weights and Apgar scores [30]. This review is crucial for directing epidemiology, aetiology, impact, and management strategies because WHO's 2025 goal to halve prevalence is not being met [6-30].

1.1. Study Objectives

- 1) To evaluate the global prevalence and regional variations of anaemia in pregnancy, focusing on low- and middle-income countries (LMICs).
- 2) To identify the primary causes and risk factors contributing to anaemia during pregnancy, including nutritional deficiencies and socioeconomic factors.
- 3) To assess the maternal and foetal health implications of anaemia, such as low birth weight, preterm delivery, and maternal mortality.
- 4) To review current diagnostic and screening methods for early detection of anaemia in pregnant women.
- 5) To explore effective prevention and management strategies, including supplementation, prenatal care, and nutritional education.
- 6) To highlight barriers to achieving the World Health Organization's goal of reducing anaemia prevalence by 50% by 2025 and propose targeted interventions.

2. Epidemiology and Prevalence

Pregnancy-related anaemia is a serious worldwide health concern, and its prevalence varies greatly by geography and socioeconomic status. According to the World Health Organization (WHO), it is defined as a haemoglobin (Hb) level less than 11 g/dL, with modifications made for variations in blood volume that occur during different trimesters [6,10]. The WHO criteria, which use thresholds of 11.0 g/dL for the first and third trimesters and 10.5 g/dL for the second, are used in this study to identify anaemia when Hb falls below 11 g/dL [1].

These differences are particularly noticeable in LMICs, where higher rates are a result of infectious diseases, inadequate nutrition, and restricted access to healthcare [7-9]. South Asia bears 52% of the burden, Africa 46%, and developed regions 23% [10]. Although some studies report a lower prevalence of 21.6%, in contrast to other West African countries, it is still a persistent concern in The Gambia, where prevalence varies from 60% to 70% across

regions [7,20]. The severity of the condition tends to increase during pregnancy, reaching a peak of 27.8% in the second trimester, followed by 5.44% in the third and 2.34% in the first. The third trimester saw a notable increase to 65%, compared to 47% in the second ($P = 0.03$) [1-6,8,26]. The WHO classification as detailed in the introduction applies [6]. The majority of cases are categorised as mild (47%) or moderate (47%). Given that the condition deteriorates with gestation and is impacted by variables such as multiple pregnancies, low socioeconomic status, and inadequate supplementation, such variations underscore the need for focused interventions [3,19]. Statistically significant ($p < 0.05$) risk factors include being older than 30, living in a rural area, not having received any education, having a short birth interval, not taking iron supplements, having parasite infections, having fewer than five prenatal visits, being multiparous, and having a low income [6]. In order to highlight the epidemiological challenge and provide guidance for future research and policy development, this analysis gathers evidence.

3. Pathophysiology and Classification

Pregnancy anaemia is caused by a complex combination of physiological changes and underlying medical conditions, and it has a significant impact on the health of the mother and the foetus. In order to account for the natural expansion of blood volume, the World Health Organization (WHO) classifies it as a haemoglobin (Hb) level below 11 g/dL, with adjustments made throughout trimesters [6,9]. Iron, folate, and other nutrients are needed to support foetal growth and accommodate the increased blood supply as pregnancy progresses and the foetus develops. If dietary intake or absorption is inadequate, this can increase the risk of anaemia [8-11].

The main cause, which accounts for roughly 75% of cases globally, is iron deficiency, which causes haemoglobin production to be disrupted, resulting in smaller, paler red blood cells [9]. Other contributing factors include haemoglobinopathies, chronic infections that affect red blood cell function, and deficiencies in folate and vitamin B12, which can result in megaloblastic anaemia [4,12,24]. The body's reserves may be strained by the increased nutrient demands during pregnancy, particularly in women who already have nutritional deficiencies [19,30].

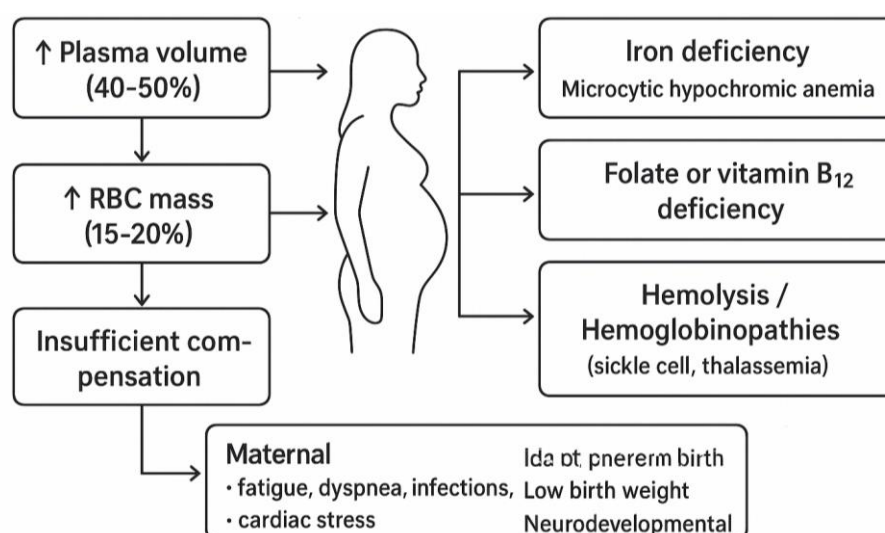


Figure 1. Pathophysiology of anaemia in pregnancy

The WHO classification as detailed in the introduction applies [6]. The majority of cases are mild or moderate (47% each), and prevalence tends to increase, reaching 65% in the third trimester compared to 47% in the second ($P =$

0.03) [1,18,22]. Given that severe cases are associated with increased risks of complications, this classification encourages targeted interventions [5-8]. The foundation for comprehending its classification and mechanisms for better clinical management is laid out in this overview.

4. Clinical Manifestations and Symptoms

Pregnancy-related anaemia affects both the mother's health and the growth of the foetus and manifests as a range of symptoms related to the blood's decreased capacity to carry oxygen. The threshold is set by the World Health Organization (WHO) at a haemoglobin (Hb) level less than 11 g/dL, with modifications made for variations in blood volume that occur during different trimesters [1]. According to the WHO definition, anaemia is diagnosed in this study when haemoglobin levels fall below 11 g/dL, with 11.0 g/dL for the first and third trimesters and 10.5 g/dL for the second [7,8]. As the body adapts to decreased haemoglobin levels, common symptoms include fatigue, pallor, and dyspnoea [6-9]. Due to increased physiological demands as pregnancy progresses, these symptoms often get worse [6].

In more severe cases, the body may struggle with a prolonged oxygen shortage, as evidenced by symptoms like dizziness, a fast heartbeat, and cravings for non-food items (pica) [6]. Iron deficiency is the primary cause of the condition, along with deficiencies in folate and vitamin B12, infections like malaria, haemoglobinopathies, and chronic illnesses [10,17]. Paleness is a visible indicator of the severity of anaemia, particularly in the conjunctiva, nails, and mucous membranes [16-19]. Severe cases may result in low birth weight, preterm delivery, miscarriage, and hypertension, among other long-term complications for the mother, foetus, and newborn [2,6].

The WHO classification as detailed in the introduction applies [6,7]. Symptom severity is correlated with the extent of anaemia. Prevalence increases to 65% in the third trimester compared to 47% in the second ($P = 0.03$) [3], with the majority of cases being mild or moderate (47% each) [8]. Reducing complications such as increased maternal fatigue and foetal growth problems requires early detection and treatment [1-3]. The main symptoms listed in this section are essential for an early diagnosis and treatment.

5. Maternal and Fetal Implications

Pregnancy anaemia is a serious public health concern since it has a substantial impact on the health of the mother and the development of the foetus. With trimester-specific adjustments for the normal rise in blood volume, the World Health Organization (WHO) defines it as a haemoglobin (Hb) level less than 11 g/dL [16-19]. According to the WHO standard, anaemia is diagnosed in this study when haemoglobin levels fall below 11 g/dL, with 11.0 g/dL for the first and third trimesters and 10.5 g/dL for the second [1,20]. In more severe cases, it increases the risk of heart strain, exhaustion, and serious problems like postpartum haemorrhage for mothers [2]. These hazards also affect foetal development, which can lead to issues that impact both the mother and the unborn child [28].

Equally at risk is the health of the foetus, as anaemia is linked to stunted growth during pregnancy, premature birth, and low birth weight, all of which can result in long-term developmental difficulties [14]. These risks are increased by the increasing oxygen requirements during pregnancy, especially when paired with infections or nutrient deficiencies [1]. Iron deficiency is the primary cause of the condition, but it can also result from folate and vitamin

B12 deficiencies, infectious diseases, haemoglobinopathies, and chronic conditions. The situation is further complicated by increased nutrient demands [1,2].

The WHO classification as detailed in the introduction applies [6]. The majority of cases are mild or moderate (47% each), and prevalence increases, reaching 65% in the third trimester compared to 47% in the second ($P = 0.03$) [6,9]. These consequences highlight how urgent action is required to safeguard the health of both the mother and the foetus [1-3]. The major health issues that call for targeted interventions are highlighted in this section.

6. Diagnosis and Screening

The World Health Organization (WHO) defines anaemia in pregnancy as a haemoglobin (Hb) level below 11 g/dL, adjusted for trimester-specific changes due to increased blood volume [6]. Early diagnosis and screening are necessary to prevent adverse outcomes. According to the WHO criteria, which are 11.0 g/dL for the first and third trimesters and 10.5 g/dL for the second, anaemia is defined in this study as Hb falling below 11 g/dL [9]. In order to assess Hb levels, mean corpuscular volume (MCV), and red cell indices and help identify the type of anaemia, the diagnostic procedure begins with a complete blood count (CBC) [3-6]. Iron deficiency, the primary cause, is confirmed by additional tests such as serum ferritin or total iron-binding capacity [8-11].

A crucial component of preventive care is screening, which is recommended at the first prenatal visit and then again in subsequent trimesters to monitor Hb changes [6]. Significant statistical relationships ($p < 0.05$) are found between risk factors like being over 30, living in a rural area, not having received any education, having short birth intervals, not taking iron supplements, having parasitic infections, having fewer than five prenatal visits, having multiple pregnancies, and having low income. In the third trimester, the prevalence increases significantly to 65% from 47% in the second ($P = 0.03$). The WHO classification as detailed in the introduction applies [2,8]. 47% of cases are mild or moderate [12-18]. To begin treatment and track progress, early identification is crucial, especially for at-risk groups [7]. The importance of prompt intervention is highlighted by the growing foetus's increased metabolic and hormonal demands, which increase the need for iron, folate, and other nutrients to support development and blood volume [5-8]. The crucial screening and diagnostic techniques required for efficient anaemia treatment are highlighted in this section [9].

7. Discussion

Pregnancy-related anaemia remains a significant global health issue, with regional variations in prevalence, especially in low- and middle-income countries where many pregnant women suffer from it. Anaemia is more likely during pregnancy due to the increased demands, such as higher blood volume and iron requirements, especially when paired with poor nutrition and restricted access to medical care. The illness is made more complex by its complex aetiology, which is primarily brought on by iron deficiency but also involves folate and vitamin B12 deficiencies as well as infections like malaria. In marginalised communities, the risk is increased by economic hardships, illiteracy, and closely spaced pregnancies, which feed a vicious cycle of nutrient loss and deteriorating health. Clinically, anaemia can show up as a range of symptoms, from mild pallor and fatigue to more serious ones like increased heart rate and odd cravings that get worse as pregnancy goes on. These indicators are crucial for medical professionals and emphasise the significance of early identification because the condition tends to worsen

in its later stages. More than just discomfort results; the foetus experiences challenges such as stunted growth and preterm birth, and the mother's health is jeopardised by heart stress and a higher chance of excessive bleeding following delivery. These effects are more severe when anaemia is severe, which emphasises how important it is to fully comprehend how it arises.

There are two approaches to treating anaemia: first, treating the underlying causes, like infections; and second, treating existing cases with specialised iron treatments or, in severe cases, blood transfusions. Prevention, which relies on regular prenatal checkups and dietary recommendations that are high in nutrients, is the key to long-term progress. The unequal implementation of these regulations, especially in areas with weak healthcare systems and traditional eating habits, is a significant barrier. Progress toward WHO's 2025 target to reduce anaemia prevalence by 50% has been slower than anticipated due to structural challenges, demonstrating that existing efforts, although helpful, are insufficient to meet the task's requirements.

This analysis also identifies data gaps, such as differences in screening and diagnostic methods that may distort estimates of prevalence. Because the emphasis on iron deficiency may obscure other factors, like genetic blood disorders, more research is required. Future initiatives should focus on uniform screening standards and affordable, locally relevant solutions, such as neighbourhood health initiatives or enriched foods. If paired with more comprehensive maternal health programs, these might be more successful. In order to break the cycle of anaemia, treating anaemia during pregnancy ultimately requires a comprehensive strategy that links public health regulations, healthcare, and community involvement.

8. Conclusion

Anaemia in pregnancy remains a major global challenge, characterized by its high prevalence and serious implications for the health of women and their foetuses. Its origins lie in nutritional shortfalls, worsened by economic and social challenges, necessitating a broad approach to address it effectively. The dangers it poses to mothers, such as heightened bleeding risks, and to foetuses, including impaired growth, highlight the urgent need for prompt intervention. Effective control can be achieved through targeted supplementation and therapy, alongside preventive measures like improved prenatal monitoring and better nutrition, offering a promising direction. Reaching international health objectives will depend on ongoing investment in medical facilities and education, especially in vulnerable areas. This final thought serves as a call to action to embark on a collective effort towards comprehensive approaches that will improve health outcomes for pregnant women and their babies.

8.1. Future Suggestions

- 1) Develop standardized global screening protocols to ensure consistent diagnosis and monitoring of anaemia in pregnancy across regions.
- 2) Invest in community-based nutritional education programs to promote dietary diversity and reduce reliance on traditional diets that may inhibit iron absorption.
- 3) Enhance healthcare infrastructure in low- and middle-income countries to improve access to prenatal care and supplementation programs.

- 4) Conduct further research into the role of non-iron-related causes of anaemia, such as haemoglobinopathies and vitamin deficiencies, to inform targeted interventions.
- 5) Implement affordable, locally relevant food fortification strategies to address nutritional deficiencies in vulnerable populations.
- 6) Strengthen public health policies to address socioeconomic determinants, such as poverty and illiteracy, that exacerbate anaemia prevalence.

Declarations

Source of Funding

This study received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing Interests Statement

The authors declare that they have no competing interests related to this work.

Consent for publication

The authors declare that they consented to the publication of this study.

Authors' contributions

All the authors took part in literature review, analysis, and manuscript writing equally.

Availability of data and materials

Supplementary information is available from the authors upon reasonable request.

Institutional Review Board Statement

Not applicable for this study.

Informed Consent

Not applicable for this study.

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